

# इंटरनेट

# मानक

## Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 7146-3 (1974): Methods of measurement on photosensitive devices, Part 3: Photoconductive cells for use in the visible spectrum [LITD 4: Electron Tubes and Display Devices]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”



BLANK PAGE



“पुनर्पुष्ट १९९५”  
“RE-AFFIRMED 1995”

IS : 7146 ( Part III ) - 1974

*Indian Standard*

**METHODS OF MEASUREMENTS ON  
PHOTOSENSITIVE DEVICES**

**PART III PHOTOCONDUCTIVE CELLS FOR USE  
IN THE VISIBLE SPECTRUM**

“पुनर्पुष्ट १९९०”  
“REAFFIRMED 1990”

UDC 621.383.4 : 535.247.4



© Copyright 1975

**INDIAN STANDARDS INSTITUTION**  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110001

*Price Rs 5<sup>00</sup>*

*May 1975*

*Indian Standard*METHODS OF MEASUREMENTS ON  
PHOTOSENSITIVE DEVICESPART III PHOTOCONDUCTIVE CELLS FOR USE  
IN THE VISIBLE SPECTRUM

Electron Tubes Sectional Committee, ETDC 39

*Chairman*

PROF S. SAMPATH

Indian Institute of Technology  
Madras*Members*

DR S. S. S. AGARWALA

DR N. C. VAIDYA ( *Alternate* )

SHRI H. K. L. ARORA

SHRI R. G. KESWANI ( *Alternate* )  
( BOMBAY )SHRI A. K. GHOSH ( *Alternate* )  
( CALCUTTA )SHRI S. SINGARAVEL ( *Alternate* )  
( MADRAS )

SHRI B. P. CHATURVEDI

SHRI P. SETH ( *Alternate* )DIRECTOR, ELECTRICAL  
ENGINEERING

DIRECTOR, ELECTRICAL ENGINEERING

( MATERIAL ) ( *Alternate* )DIRECTOR, ELECTRONICS & RADAR  
DEVELOPMENT ESTABLISHMENT

SHRI B. P. GHOSH

SHRI P. K. JAIN

SHRI R. K. JAIN

SHRI E. G. NAGARAJAN

SHRI R. C. PANDEY ( *Alternate* )

SHRI K. M. RAMASWAMY

SHRI BALRAJ BHANOT ( *Alternate* )*Representing*Central Electronics Engineering Research Institute  
( CSIR ), Pilani

All India Radio and Electronics Association, Bombay

Directorate General of Civil Aviation ( Ministry of  
Tourism & Civil Aviation ), New Delhi

Naval Headquarters

Ministry of Defence ( R&amp;D )

National Test House, Calcutta

Electronic Components Standardization Organi-  
zation ( Ministry of Defence )Radio Electronics & Television Manufacturers'  
Association ( RETMA ), CalcuttaDirectorate of Technical Development & Production  
( Air ) ( Ministry of Defence ), New DelhiDirectorate General of Technical Development, New  
Delhi

( Continued on page 2 )

© Copyright 1975

INDIAN STANDARDS INSTITUTION

This publication is protected under the *Indian Copyright Act* ( XIV of 1957 ) and reproduction in whole or in part by any means except with written permission of the publisher shall be deemed to be an infringement of copyright under the said Act.

## IS : 7146 ( Part III ) - 1974

(Continued from page 1 )

### *Members*

SHRI P. K. RAO

SHRI E. V. R. RAO  
RESEARCH ENGINEER  
SHRI P. S. SARAN

SHRI G. H. VAZE  
DR R. P. WADHWA  
SHRI N. SRINIVASAN,  
Director ( Elec tech )  
( Secretary )

### *Representing*

Directorate General of Inspection ( Ministry of  
Defence ), New Delhi  
Electronics Corporation of India Ltd, Hyderabad  
All India Radio, New Delhi  
Posts & Telegraphs Board ( Telecommunication  
Research Centre ), New Delhi  
Bhabha Atomic Research Centre, Bombay  
Bharat Electronics Ltd, Bangalore  
Director General, ISI ( *Ex-officio Member* )

## Panel for Special Purpose Tubes, ETDC 39: P6

### *Convener*

SHRI G. H. VAZE

Bhabha Atomic Research Centre, Bombay

### *Members*

SHRI P. K. PATWARDHAN  
SHRI E. V. R. RAO  
SHRI K. S. SREE PRAKASH

Atomic Energy Establishment, Bombay  
Electronics Corporation of India Ltd, Hyderabad  
Bharat Electronics Ltd, Bangalore

*Indian Standard*  
**METHODS OF MEASUREMENTS ON  
PHOTOSENSITIVE DEVICES**  
**PART III PHOTOCONDUCTIVE CELLS FOR USE  
IN THE VISIBLE SPECTRUM**

**0. FOREWORD**

**0.1** This Indian Standard was adopted by the Indian Standards Institution on 11 December 1974, after the draft finalized by the Electron Tubes Sectional Committee had been approved by the Electrotechnical Division Council.

**0.2** In preparing this standard, assistance has been derived from IEC Pub 306-3(1970) 'Measurement of photosensitive devices, Part 3 Methods of measurement of photoconductive cells for use in the visible spectrum' issued by the International Electrotechnical Commission.

**0.3** This is one of a series of Indian Standards on photosensitive devices. Other standards so far published are given on 4th cover page.

**0.4** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960\*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

---

**1. SCOPE**

**1.1** This standard ( Part III ) describes measuring methods for photoconductive cells for use in the visible spectrum shall apply.

**2. TERMINOLOGY**

**2.0** For the purpose of this standard, the terms and definitions covered in IS : 1885 ( Part IV/Sec 8 )-1973†.

**3. MEASURING METHODS**

**3.1 Luminous Sensitivity** — Prior to measurement, the cell shall attain a prescribed light exposure history. Average room light ( minimum 250 lx ) is suggested as a standard history.

\*Rules for rounding off numerical values ( revised ).

†Electrotechnical vocabulary : Part IV Electron tubes, Section 8 Photosensitive devices.

**3.1.1** Infinite dark history is proposed as a secondary reference history due to its importance in existing applications. The duration of life history shall be sufficient to attain equilibrium or stability.

**3.1.2** Measurements shall be made at room temperature ( $25 \pm 5^{\circ}\text{C}$ ).

**3.1.3** The cell under measurement shall be exposed to known illuminance of 2854 K [ see 4.1 of IS : 7146 ( Part I )-1973\* ].

**3.1.4** Current shall be measured at an applied potential below that at which non-linearity or temperature rise becomes appreciable.

**3.1.5** Extreme care is required to keep the overall error below 5 percent.

**3.1.6** At low illuminance ( where response tends to be slow ), a duration of time shall be allowed, which is long enough for stable conditions to be attained but short enough to avoid the effect of drift to equilibrium at the illuminance level, because of memory effect.

**3.1.7** The measurement results may be presented as a curve representing the current ( or the conductance or resistance with applied voltage stated ) versus illuminance over the range for which the cell is suitable. Owing to the wide ranges involved, logarithmic co-ordinates are to be preferred.

**3.1.8** Dark current shall be measured under the same conditions, after a stated history.

**3.1.9** The area of the sensitive surface to be illuminated, or the window aperture, shall be indicated on the outline drawing.

**3.2 Rise Time and Fall Time** — An energy modulator or mechanical shutter is used to form specified incident energy pulses. A specification for the energy pulse shall include the amplitude, duration, rise time, fall time and frequency of the excitation pulses. The spectral distribution of the source shall be specified together with the energy level for the 'on' condition. The 'off' condition shall be dark or that no-energy condition which cannot be altered by further shielding ( see Fig. 1 for a typical set-up for measurement ).

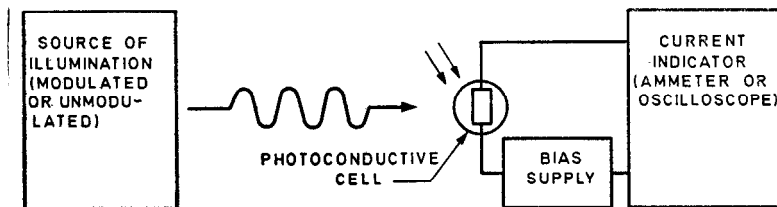


FIG. 1 TYPICAL SET-UP FOR MEASUREMENT OF RISE TIME AND FALL TIME

\*Methods of measurements on photosensitive devices, Part I Basic considerations.

**3.2.1** Single step pulse or pulse train methods are permitted, provided the appropriate precautions are taken. Switching times of energy pulses shall be appropriately small compared with those being measured.

**3.2.2** This may necessitate monitoring by an auxiliary detector of stated characteristics. Energy pulse duration shall be sufficiently long to allow characteristic stabilization before fall time measurements. It is desirable, because of the non-linear response to incident energy of some devices, that the response time be stated at two or more levels of energy.

**3.2.3** The illumination shall be directed along the viewing axis of the device and uniformly distributed over the active surface. Values of ambient temperature, bias and load, and the orientation and masking or aperture arrangement used in the measurement shall be described. Where applicable, the history of the device, time in operation and time in storage shall be stated.

**3.2.4** The maximum resistance in the measuring circuit shall be less than one percent of the lowest value of the cell resistance during the measurement.

**3.3 Relative Spectral Sensitivity** — In determining the relative spectral sensitivity of a photoconductive cell, the radiation from a monochromator ( *see* Note ) is allowed to fall on the cell and the output is noted. A calibrated thermopile detector with a flat response in the region of interest is used to monitor the radiation from the exit slit.

NOTE — In many cases, a set of filters may be used, calibrated against a monochromator.

**3.3.1** If the measurement is made at equal energy levels, the radiant energy falling on the cell shall be maintained the same at all wavelengths. The values obtained will hold only for that specific level.

**3.3.2** To obtain values of the relative spectral sensitivity which are not dependent on the signal level, the measurement shall be made at a specific level of photocurrent or photoresistance by adjustment of the value of radiant energy at each wavelength.

**3.3.3** The bandwidth of the incident radiation shall not exceed a stated percentage of the wavelength concerned.

**3.3.4** Both ac and dc methods of measurement are permitted, provided the appropriate precautions are taken. With the former, the chopping frequency and, where significant, the amplifier bandwidth shall be stated.

**3.3.5** If the absolute value of spectral sensitivity, for example, in amperes per watt, for any wavelength is given, the value of absolute spectral sensitivity at any other wavelength may be derived from the values of relative spectral sensitivity.

**3.3.6** The ambient temperature at the time of measurement shall be stated.

**3.4 Temperature Dependence** — Illumination sensitivity over a range of ambient temperatures may be measured, as in 3.1, and plotted as a set of curves for various incident light levels.

**3.5 Illumination Resistance** — The illumination resistance is calculated as the quotient of the voltage across the device by the current flowing through the device. Other conditions of operation and the history of the device shall be stated.

**3.6 Illumination Current** — The device is subjected to a stated illumination and a stated voltage is applied to the device. The illumination current is measured after a stated time under the stated conditions. The history of the device shall be given.

**3.7 Dark Resistance** — The dark resistance is calculated as the quotient of the voltage across the device and the current flowing through the device at a stated time after removal of the stated illumination.

**3.8 Dark Current** — The device is subjected to certain stated operating conditions. Immediately after stopping the stated illumination, a stated voltage with a stated series resistance is applied to the device. The dark current is measured at a stated time after the instant of stopping the illumination.